EXPERIMENTAL DISEASE BASED PRICE INDEXES USING THE CPI PRODUCTION DATABASE AND THE MEDICAL EXPENDITURE PANEL SURVEY

Ralph Bradley*
Lyubov Rozental
US Bureau of Labor Statistics
2 Massachusetts Avenue NE
Washington, DC 20212

Abstract:

We generate diseased based indexes that fulfill recommendation 6-1 of the Committee on National Statistics as outlined in Schultze and Mackie (2002). This study reports the results of this project. When pricing total expenditures, we find that updating utilizations generates a 2.4% drop in the cumulative medical price index from 1999 to 2004; however, when we price solely consumer out-of-pocket payments there is a 3.3% increase when utilizations are updated. These contradictory results occur because most of the savings from the substitution from inpatient hospital services to outpatient services accrue to insurance reimbursements. Insured consumers on average have lower coinsurance rates for inpatient hospital services than they do for outpatient services and pharmaceutical goods. This shift can often times increase their out of pocket payments. We also address the problem of co morbidities. We compute indexes where a service that treats more than one disease is be pro rated to each treated disease. This causes a significant drop in the price index.

* Corresponding author: Bradley.ralph@bls.gov – 202-691-6575. The opinions expressed in this document are solely those of the author and do reflect policies or procedures at the US Bureau of Labor Statistics.

I. Introduction

Rising health care costs are a key domestic concern. Many poll results show that American voters believe that this problem is a major public policy issue. As Americans age, their medical risks increase, and income protection against catastrophic diseases becomes increasingly important. There is a general belief that medical costs are increasing, and that there is not enough information about the reasons that they are rising more rapidly than the costs of other goods and services.

Currently the Producer Price Index (PPI) generates price indexes for select providers of medical goods and services. These goods and services must be domestically produced. Not all these goods and services are consumed by the American consumer. Likewise, the Consumer Price Index (CPI-U) publishes medical price indexes for services such as professional office visits, hospital and related services, and prescriptions. Here the CPI-U attempts to capture the price growth for those medical items that are financed either directly from consumer pockets or from the health insurance reimbursements that are financed either by the employee's contribution to a health plan premium, or the Medicare part B premium payments remitted by households.[1]

As long ago as 1967, it was recognized that[2]

> "...the average consumer of medical care is not as interested in the price of a visit or hospital day as he is in the total cost of an episode of illness."

However, neither the PPI nor the CPI-U medical indexes track the price of treating the entire episode of a disease.[3] Therefore, one cannot use BLS price indexes to determine if

the price of treating say a mental illness is rising more rapidly than the price for treating diabetes.

Academic economists have also done studies on the issue of pricing episodes of illness rather than just the goods and services used to treat them. Shapiro and Wilcox (1996) construct a price index for treating cataract surgery. They find that during the last quarter of the 20th century that there was a shift from using an inpatient hospital for this procedure to using outpatient surgical centers. This service substitution reduced the price of treating cataracts, and this price reduction was not reflected the CPI-U. Cutler et. al (1998) look at treating Acute Myocardial Infarction (AMI, heart attacks). They find that when taking into account the increased longevity resulting from the new surgical procedures, prices for treating AMI had actually decreased, and the CPI-U has not been adjusted for this. Finally, Berndt et. al (1998, 2002) find that the prices for treating depression had fallen with the introduction of a new generation of anti-depressant, the Selected Serotonin Reuptake Inhibitor (SSRI).

The Boskin Commission[4] report also criticizes the CPI-U since it does not properly account for substitution effects when the price of one substitute becomes relatively lower than another substitute, and it does not adjust for improved health outcomes. The studies in the previous paragraph are specific examples of the Boskin Commission criticism.

Under current national accounts, it is the provider service or good that is deemed the final good and not the healing from an episode. There is an effort at the US Bureau of Economic Analysis (BEA) to create a satellite account that would restate the final medical good as the entire treatment of a disease. This data would be in current dollars and to derive real dollar amount one could use price indexes for these disease treatments.

The Bureau of Labor Statistics (BLS) has started to generate experimental disease based

price indexes that would measure the total price increase of treating each major disease.

This study is not BLS's first attempt to generate disease based price indexes. In its

publication, *At What Price?,* the Committee on National Statistics (CNSTAT) made the

following recommendation:

> "BLS should select between 15-40 diagnoses from the ICD (International
> Classification of Diseases), chosen randomly in proportion to their direct medical
> treatment expenditures and use information from retrospective claims databases to
> identify and quantify the inputs used in their treatment and to estimate their cost.
> On a monthly basis, the BLS could re-price the current set of specific items (e.g.,
> anesthesia, surgery, and medications), keeping quantity weights temporarily fixed.
> Then, at appropriate intervals, perhaps every year or two, the BLS should
> reconstruct the medical price index by pricing the treatment episodes of the 15 to
> 40 diagnoses—including the effects of changed inputs on the overall cost of those
> treatments. The frequency with which these diagnosis adjustments should be
> made will depend in part on the cost to BLS of doing so. The resulting MCPI
> price indexes should initially be published on an experimental basis. The panel
> also recommends that the BLS appoint a study group to consider, among other
> things, the possibility that the index will 'jump' at the linkage points and whether
> a prospective smoothing technique should be used."

BLS contracted with Thompson Healthcare Company to construct indexes that met this

recommendation. The data source was an insurance claim file for self insured

companies. Medical indexes were constructed for 3 metropolitan areas where 40

narrowly defined diseases were selected randomly with a probability of selection that was

proportional to the area's expenditure share on each disease. Each year the inputs used to

treat the selected diseases were updated and reflected in the index.

The results of this study are reported in Song et. al. (2008).[5] While the price

indexes computed under the method recommended by CNSTAT did not have statistically

significant differences with the indexes computed under current BLS methods, their point

estimates were lower. However, there were challenges to this study. First, the insurance

claims data base only contained records for insured patients, and therefore did not represent those who only had public insurance or who were uninsured. Since the claims data base only covered those companies that had contracted with Thompson, there was no assurance that it was even representative of the privately insured population. There was also unobserved patient additions and attrition from the data base, and therefore it was not possible to determine if the change in inputs was the result of using inputs more efficiently or the result of a change in patient mix. There were several claim records that did not have a diagnosis (orphan records), and therefore, it was evident that we could not guarantee that we were getting all the treatments being used to treat a particular disease. Finally, under the CNSTAT recommendation, it was only possible to track the price indexes of the randomly selected diseases. Therefore, a patient who was diagnosed with a disease that was not in the sample could not track the aggregate price of treating that disease. The price index differences were not statistically significant because of the large variances in the price indexes. One reason that these variances were so large was that the selected diseases were so narrowly defined that there were not adequate degrees of freedom to produce adequately small variances so that one could get statistical significance.

Claims data for private insurance is very expensive to purchase on a timely basis, and it would be very expensive for BLS were to use claims data in the computation of its published indexes.

In this study, we follow the CNSTAT recommendation that Song et al (2008) followed, except that instead of randomly selecting narrowly defined diseases with probability in proportion to their expenditure share, we generate an index for every major

disease category (i.e. for each chapter in the ICD-9 manual).[6] This allows us to

determine the contribution of each disease to the entire medical price index. We use the

Medical Expenditures Panel Survey (MEPS) instead of claims data to update the input

quantities for each disease. Since this database is representative of the non

institutionalized civilian population, it gives us a better representation of what inputs are

used on average to treat a disease. There are other reasons for using MEPs. The data set

is in the public domain; so BLS does not need to make large outlays to use it as it would

for a claims data base. The only other way for BLS to get a representative sample of

medical utilizations and expenditures by disease would be to implement a new survey

and not only would this be expensive but it would delay the publication disease based

indexes.

Because we compute indexes for the major disease groups rather than for randomly

selected diseases from narrowly defined disease categories, we were able to get more

observations per disease, and this greatly reduced the variances of our price indexes and

unlike the Song et. al (2008) we were most times able to statistically significant results.

The MEPS utilization and disease expenditure data was combined with the CPI-U

prices indexes for major medical goods and services such as Hospital and Related

Services, Professional Medical Services (i.e. physician, dentists, and other professionals).

With the combined data, we could update as recommended by CNSTAT on a yearly basis

the average utilization, and expenditure for each medical good and service used to treat

each major disease.[7] The BLS price indexes for medical goods and services allowed us to

determine the monthly price increases. This gave us enough information to compute price

indexes at the disease level on a monthly basis, and it would give us enough information to add disease based price indexes to BLS's monthly publication.

The utilization data also allows us to account for substitutions of goods and services in the treatment of diseases. For instance, if there was a shift from inpatient hospital to surgical centers for the treatment of eye diseases, this would show up in the MEPS data. When these utilizations are updated in the index, there should be a downward jump in our price index for the treatment of diseases in the sense organs as we did not link out the effects of the quantity change. Additionally, these utilization updates would allow us to also account for any intensity changes for a particular disease. We find that for some diseases such as diabetes there is an increased utilization for pharmaceuticals, physician, and hospital services. When we update utilizations for this disease, the price index is higher than it would have been had we not adjusted for utilization.

We still are not able to adjust our indexes for change in treatment outcomes. There still are many problems in this type of quality adjustment. First, both the CPI-U and the PPI need to be computed on a timely monthly basis. For example, in March of 2004, BLS must disseminate the price indexes for February 2004. Unfortunately, when a medical service is delivered in February 2004, the full outcomes are not realized at that point in time. Often times, it can take years to observe the full effects. Second, outcome changes are by themselves difficult to measure; it is even more difficult to estimate the value of the changed outcome. There is much room for error in trying to do these. BLS is in constant communication with experts in the medical field in order to find ways that it can publish a real time index that does account for improved outcomes.

Section II outlines in a simple how the current CPI-U is computed, and then compares it to the updating method proposed by CNSTAT. Section III describes the results of this study and Section IV concludes.

II. Different Methods to Compute Medical Price Indexes

Let d index the set of diseases that one can contract (infection, cancer, diabetes, etc.) and s index the set of medical goods and services (physician services, hospital services, etc) that one can use to treat disease. In time period t, the price of treating disease d with service s is P_{dst} and the quantity of service s used to treat d is Q_{dst}. The current Medical CPI-U attempts to approximate the Lowe Index[8]

(1) $\qquad I_{t,t-1}^{L} = \dfrac{\sum_{s}\sum_{d} P_{sdt} Q_{sd0}}{\sum_{s}\sum_{d} P_{sdt-1} Q_{sd0}}.$

Unlike a Laspeyres Index the quantities come from a base period 0 which precedes period t-1. One can make the following algebraic changes:

(2) $\qquad \dfrac{\sum_{s}\sum_{d} P_{sdt} Q_{sd0}}{\sum_{s}\sum_{d} P_{sdt-1} Q_{sd0}} = \dfrac{\sum_{s}\sum_{d} \frac{P_{sdt}}{P_{sdt-1}} Q_{sd0} P_{sdt-1}}{\sum_{s}\sum_{d} P_{sdt-1} Q_{sd0}} = \dfrac{\sum_{s}\sum_{d} \frac{P_{sdt}}{P_{sdt-1}} \frac{Q_{sd0} P_{sdt-1}}{\sum_{d} Q_{sd0} P_{sdt-1}} \sum_{d} Q_{sd0} P_{sdt-1}}{\sum_{s}\sum_{d} P_{sdt-1} Q_{sd0}}.$

Let $\Delta P_{st} = \sum_{d} \dfrac{P_{sdt}}{P_{sdt-1}} \dfrac{Q_{sd0} P_{sdt-1}}{\sum_{d} Q_{sd0} P_{sdt-1}}$, and $w_{s,t-1} = \dfrac{\sum_{d} P_{sdt-1} Q_{sd0}}{\sum_{s}\sum_{d} P_{sdt-1} Q_{sd0}}$, then the current Lowe index can be written as

(3) $\qquad I_{t,t-1}^{L} = \sum_{s} \Delta P_{st} w_{st-1}.$

Currently the Bureau of Labor Statistics attempts to estimate this last form by collecting ΔP_{st} from medical providers of goods and services and using the Consumer

Expenditure Survey to estimate $w_{s,t-1}$. When BLS estimates its index it does not observe

quantities directly, rather they are imputed from the "proportional to spending" sampling

method. When BLS initiates a price quote it controls for certain characteristics; for

hospitals, it controls for inpatient or outpatient services, and for physicians it controls for

the Current Procedural Terminology (CPT) Code. It will then sample for these

characteristics proportional to their revenue share. Letting k index the BLS sampling

characteristics for a particular service s, the probability that a quote with characteristic k

is selected in the initiation period 0 is its expenditure share denoted w_{sk0}. For the

expectation of the index to approximate a Lowe, the resulting quote is divided by a base

price. To see this, the resulting index is:

$$(4) \qquad \widehat{I}_{st} = \frac{\sum_{k=1}^{N_s} P_{skt} \chi(k \; is \; selected) / P_{isk0}}{\sum_{k=1}^{N_s} P_{skt-1} \chi(k \; is \; selected) / P_{isk0}}$$

where $\chi(.)$ is the indicator function and N_s is the number of characteristics. The

expectation of $P_{skt} \chi(k \; is \; selected) / P_{sk0}$ is proportional to Q_{sk0}. To see this,

$E[\chi(k \; is \; selected)] = w_{sk0}$ which is proportional to $P_{skt} Q_{sk0}$ where $E()$ is the expectations

operator. Notice that BLS does not have the treated disease as a characteristic. Therefore,

it is even possible that BLS fails to asymptotically approximate either (1) or (3). A

sufficient condition for the current BLS method to asymptotically estimate its desired

target is for the price distribution of service s to be independent of the disease that that is

treated or equivalently, $F(P_{skt}|disease = d) = F(P_{skt})$ where $F(.)$ is the distribution function

for the service price with characteristic k.

Even if BLS were successful at estimating these equations, these methods have been criticized for not accounting for the changes in protocol. Therefore, the shift from higher priced inputs to the lower priced inputs is not reflected in the CPI nor the indexes in either (1) or (3).

Presently, BLS does not collect data on the protocols for treating disease, and therefore, it would have to augment an existing survey or initiate a new survey to get this protocol information. However, MEPS does measure the services and goods used to treat diseases. We can use MEPS in a similar fashion that the Consumer Expenditure Survey (CE) is used in the construction of the CPI. While the CE provides annual weights to the various sub indexes when using them to derive an all items CPI, MEPS can provide annual quantity weights for the various goods and services used to treat a particular disease.

In this study, we compute diseased indexes for each disease following the guidelines of the CNSTAT recommendation. Continuing with the notation, let t denote the time period in a month, year framework. For example, t might equal February, 2004. Let $y(t)$ be just the year part of the time period. For example $y(\text{February}, 2004) = 2004$. From MEPS, we can get $Q_{sdy(t)}$ which are yearly average quantities of service s used to treat a disease in year $y(t)$. We cannot get a monthly Q_{sdt} because MEPS is not a monthly survey in the same way that the BLS Consumer Expenditure Survey is not a monthly survey.

Instead of attempting to estimate (1), for the months of February to December we attempt to estimate

$$(5) \quad I^D_{t,t-1} = \frac{\sum_s \sum_d P_{sdt} Q_{sd,y(t)-1}}{\sum_s \sum_d P_{sdt-1} Q_{sd,y(t)-1}}.$$

The $Q_{sd,y(t)-1}$ are the lagged year quantities that come from MEPS. The P_{sdt} are monthly

prices where $P_{sdt} = IX_{st} * P_{sdt-1}$, and IX_{st} is the period t-1 to t CPI price index for service s.

The base price, P_{sd0}, comes from MEPS. The use of lagged yearly quantities is similar to

current BLS methods where the aggregation weights from the CE for the price relatives

in the CPI-U come from prior years. The obvious reason for the lag is that in time period

t the year $y(t)$ has not yet been completed, and therefore it would never be possible to

publish a price index that uses current year quantities. The January index is

$$(6) \quad I^D_{t,t-1} = \frac{\sum_s \sum_d P_{sdt} Q_{sd,y(t)-1}}{\sum_s \sum_d P_{sdt-1} Q_{sd,y(t)-2}}.$$

Notice that in January the quantities in the numerator and denominator differ. If there

have been either major substitutions or intensity changes from $y(t)$-2 to $y(t)$-1, the index

experiences a "jump" as noted in CNSTAT Recommendation 6-1. If there is either

quantity shift toward cheaper inputs or a drop in utilizations for all goods and services,

the jump is downward. If there has been an intensity increase for all the treatments, there

will be an upward jump. Thus, in January the entire effect of the quantity update is

captured.

Although the price index in (5) and (6) can update utilizations, there are

shortcomings in using them as an exact price index. They are not superlative indexes that

accounts contemporaneously for substitutions as relative prices change. However, one

might argue that it does represent an improvement over the index in (1) because changes

in protocols are slow and $Q_{sd,y(t)}$ is a better indicator of long term shifts in protocols than is Q_{sd0}. Another shortcoming is that if one were to use this to deflate aggregate medical consumption to get a real measure, one must assume that the healing outcomes from the quantity changes remain constant. This index is perhaps best used as a cost index where the patient can get information solely on the growth of required spending to treat a particular disease regardless of the outcome.

As Berndt (2008) notes, the CNSTAT recommended index better resembles a PPI rather than a CPI.[9] A CPI needs to account for the medical insurance purchases made by households, and generate an index for this purchase. The medical CPI would be a weighted index of the insurance price index and the various disease based indexes. It is challenging to construct such an index at this point in time as insurance premium data is highly proprietary, and to properly construct an insurance price index, one needs to be able to separate that part of the premium that finances the benefits and that part that covers overhead and gross profit. BLS has started to do this and has completed a preliminary study.[10] From this study, the rise in insurance prices, deductibles, copays, and the reduction in employer sponsored plans has not been appropriately factored into the current CPI-U, and if they were, the CPI-U would be higher.

Co morbidities are another issue that has to be addressed when constructing these indexes. Often times, a patient will use a service to treat more than one disease. As Table 1 shows for physician visits, co morbidities are increasing over time. The question becomes how to measure utilizations when this occurs. In this study, we generate two different sets of indexes that treat co morbidities differently. Under the first method, if a patient uses a service to treat more than one disease the use of that service is recorded for

each disease treated. In the second method, the use of the service is pro rated to each disease so that if a patient had three diseases treated for one physician visit, only 1/3 of a visit is recorded for each of the diseases treated. There are problems with both methods. The first method will over count utilizations if the patient would have used less of the service when being treated for just one of the diseases alone. In the second method, the increase in co morbidities by itself will increase the productivity of medical services solely because the patient is sicker, and the service is treating more diseases per visit. This might not be a desirable result.

There are a substantial fraction of provider treatments that are never reimbursed. The cost of these uncompensated services must be defrayed from other sources. Current CPI methods do not account for this because the price that it collects is for services that get full reimbursement. When patients pay zero prices, BLS does not collect these zero prices. The prices in the MEPS database do account for nonpayment. Average prices computed by only sampling those who do ultimately pay puts an upward bias on the average price that all patients pay. Tables 2 and 3 illustrate the problem for emergency room visits. Between 6% to 9% of all emergency room visits go un reimbursed. In 1999 there was a 5.72% increase in the share of un reimbursed emergency room visits. The average price for reimbursed visits rose more rapidly than the price for all visits. It seems plausible to believe that part of this price increase financed the increases in delinquencies. The same was true for 2000. In 2002 there was a dramatic drop in the un reimbursed share and only in this year did the "all visits" average price grow more rapidly than just the reimbursed. Over the 1998 to 2004 period, the reimbursed price is growing more rapidly than the "all visits" price while at the same time the incidence of unpaid visits is

also increasing. However, it is the "all visits" price that is the one that is reflective of all consumers, and not just those who pay. When BLS collects a price, it is just for the reimbursed visit, and it does not account for those who have been able to receive emergency room care and no reimbursement has been made on their behalf.

The notion of scope is very important in the construction of price indexes. In the medical sector there are several alternative scopes. At BEA, personal consumption expenditures (PCE) are for all expenditures regardless of how they are financed. Their corresponding price deflators are then also based on the total expenditure concept. There is also an out-of-pocket scope where only expenditures that are financed directly from consumer's disposable income are counted. Under the total expenditure scope, Medicare, Medicaid and private insurance reimbursements would be included, but would not be included in the out-of-pocket scope. Different scopes generate different prices. For the total expenditure scope, the price is the total price, where as for the out-of-pocket scope the price is merely the out-of-pocket price that the consumer pays directly. The BLS scope is a hybrid between the total expenditure scope and the out-of-pocket scope. Here, all out-of-pocket payments are included and the portion of both the public and private insurance reimbursement that is attributed to the consumer's out-of-pocket payments for premiums is also included. This includes all "employee contributions" to employer sponsored plans, and the individual's payment of the Parts B and D Medicare insurance premium. In this study we generate indexes for the total expenditure scope, the out-of-pocket scope, and the BLS scope.

III. Results

Before discussing the index results, we show both the changes in disease incidences and national spending totals by disease. Table 4 list the US total number of diagnoses for each major disease category. The Endocrine, and Nutritional disease category is growing the most rapidly. This includes all diabetes diagnoses and it confirms the rapid growth in type II diabetes in the US. The challenge here is that diabetes leads to additional co morbidities, and is in part the reason that we witness the growth in comordidities as depicted in Table 1. The increase in diabetes perhaps is also part of the reason for the increase in circulatory system disease.

Table 5 details by each major disease total US spending by service type and by major disease. It should be readily apparent that there are large variances in the growth of this spending by disease. It is not clear how much sampling error contributes to this variance as opposed to the true population variances of medical spending. 5 of the 18 categories experienced over a doubling of aggregate nominal spending from 1998 to 2004. Diseases of the Blood and blood forming organs had the greatest growth, and this was followed by Endocrine, and metabolic diseases (includes diabetes).

Table 6 lists the aggregate medical indexes based on the different methods outlines in this study for the period from 1999 to 2004. Column 1 lists the results when indexes are computed using equations (5) and (6) where utilizations are updated annually. Column 2 lists the results for indexes computed by equation (1) where a pure Lowe index is computed and there is no utilization update. Column 3 lists the indexes computed by pro rating co morbidities so that if a service treated more than one disease, the utilization of that service would be pro rated across the diseases that were treated. Under the total expenditure scope, accounting for utilization changes results in a 2.43% drop in the

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cumulative index when compared to computing no utilization adjustment. When co morbidities are adjusted there is a further 2.51% drop in the cumulative index and this reflects the effect of growing co morbidities on service productivity. Both these differences are statistically significant.

When using an out of pocket scope the results differ. Here, utilization adjustment actually increases the index by 3.32%. There are two major reasons that drive this difference. First, most of the savings that occurs is the result from shifting from inpatient services to outpatient services. The share of total medical expenditures that finance inpatient services is much higher than its out of pocket counterpart. Therefore, the savings impact from the inpatient to outpatient shift is higher for the total expenditure approach. Table 10 lists the ratio of out of pocket payments to total payments for various services from 1998 to 2004. For inpatient facilities in 2004, out of pocket payments are 1.8% of total payments while for outpatient facilities they are 6.7%. Suppose that there is a shift in 2004 from inpatient to outpatient facilities that results in a 50% saving for total expenditures. Given these ratios, consumer out of pocket payments would have still risen 86% because their rate of insurance reimbursement on outpatient services is less than their rate of reimbursements on inpatient services. A second reason that the utilization adjusted out of pocket index is higher than the unadjusted indexes is that there has been an increased utilization intensity for pharmaceuticals products and this has disproportionately affected out of pocket payments.

Since the BLS scope is a hybrid of the total expenditure and out of pocket scope, the results are mixed. There is no statistically significant difference between adjusting and not adjusting for utilization. Accounting for co morbidities does create a significant

1.75% drop in the index. While there is no statistically significant difference in the 1999-2004 period, it is possible that during other times periods there could be statistically significant difference.

Tables 7, 8 and 9 give a disease breakdown of the indexes respectively for the total expenditure scope, the out of pocket scope, and the BLS scope. Even though there is a reduction in the aggregate index for the total expenditure scope when adjusting for utilizations, there is not a reduction for every disease. When a particular disease index increases after adjusting for utilization, it can be the result either an increase in the intensity of utilizations for all goods and services used to treat the disease, or there has been a reversed shift where the more expensive service has been substitution for the less expensive service. The savings from the substitution toward less expensive inputs has been concentrated on several disease categories that have relatively large expenditure shares such categories are Neoplasms, Mental Disorders, and pregnancies where inpatient utilization has dropped dramatically.

VI. Conclusions

If one uses the total expenditure scope, then adjusting for utilizations does result in a drop in the rate of medical price growth for the 1999-2004 period. But, it does not extend to all diseases and all scopes. Most of the savings has accrued to insurance benefit payments, but it has not been realized for the consumer in terms of a drop in either out of pocket payments or lower insurance premiums. Thus, when using an out of pocket scope, there is an increase in the index when accounting for utilization changes.

During the 1999-2004 period, had BLS kept its expenditure scope and shifted from pricing services directly to pricing diseases, there would have been little change to the medical CPI.

Unlike the Song et. al (2008) study, most of our results are statistically significant. We achieved this by computing indexes for broad disease categories rather than randomly selecting 40 disease categories from a narrowly defined classification system. This gave us more degrees of freedom and reduced the variance of our parameter estimates. This is the reason for the statistically significant results. One might argue that there is little homogeneity within these broadly defined groups and that within the groups overall disease severity could vary widely. While it is true that there is much within variation in the broad categories used here, it is evident that narrowing the categories will not substantially reduce the within group variance. Bradley (2006) computed summary statistics for utilizations within a more narrowly defined Clinical Classification System. Even under this system, the standard deviations were larger relative to their means. For example the range of hospital nights used to treat an episode of Acute Myocardial Infarction ranged from zero nights to 325 nights. The diagnosis can only give limited information about the overall severity of the disease. Other factors such as age, and stage of the disease play key roles. Perhaps, when and if the reporting reforms recommended in the paragraph below are enacted some of this variance will be reduced.

We believe that our results are more representative of US consumers than the Song et. al (2008) study because our sample is representative of the entire US Civilian Non Institutional population. Song et. al (2008) uses a private claims database that

perhaps is not even representative of the privately insured population, and it covered only three metropolitan areas.

Before BLS can implement the construction and generation of disease based index, important medical reforms need to happen. The accuracy of the disease based index depends on the accuracy of the records kept by the medical system. If physicians do not accurately diagnose patients and accurately report their diagnosis, then the resulting indexes will have measurement error. Often times, the physician cannot immediately diagnose an ailment, and the record keeping system must allow for this possibility. If a physician misdiagnoses, there needs to be a process where the misdiagnosis and the corrected diagnosis can be reported. If misdiagnoses are not reported, then it is not possible to estimate the true amount of services used to treat each disease.

Another area of reform centers around the documentation of treatments prescribed to treat each diagnosis. Usually, it is the responsibility of the primary physician to organize and record all the treatments including the use of additional physician specialties. However, when physicians submit their claims to insurers, they do not give the insurer this information, and the insurer must use a "grouper" to try to determine what treatments the physician had in mind when treating a particular diagnosis. Bradley (2006) documents that these groupers generally fail to link all the goods and services that are used to treat a particular disease. Often times, there are treatments that cannot be assigned a diagnosis, and this generates what is call an "orphan" record. This means that for many diagnoses there is an under reporting of utilizations. For instance, if a Glucophage expenditure does not have a diagnoses linked to it, then there is a diabetes

diagnosis that will have the amount of prescriptions under reported. This can introduce systematic downward bias in the diseases based indexes. Other times, there are diagnoses that do not have links to all the treatments used to treat it. Bradley (2006) documents records of Acute Myocardial Infarction diagnoses that have no physician office visit assigned to them. In order to establish this diagnosis, there had to be at least one physician visit.

From the results in this study, we conclude that there have been both productivity gains and substitutions toward less expensive services that have reduced the total price of health care. However, it is also evident that it has not "trickled down" to patient out of pocket payments. Nor, has it lead to any significant reduction in premiums. Bradley (2008) constructs a Cost of Living Index that directly prices health insurance and accounts for productivity increases. From this study, it seems evident that these savings from substituting toward less expensive inputs generate savings in insurance benefit payments, but they did not induce reductions in premiums. If insurance prices are directly factored into a price index, there will be an increase in the index.

We would derive a more accurate CPI type index if we could also account for insurance prices in this study. However, this study is not "low dimensional" and it is not annual as the Bradley (2008) study, and it generates monthly indexes rather than annual indexes. Finding good data on premiums is difficult. Currently the Kaiser Research Foundation and the US Medical Expenditure Survey do annual surveys for employer sponsored insurance program. There is no survey that directly asks households about their contributions and their employer contributions to their health plans. This means that

to construct a COLI, a premium for insured household must be imputed from data from one of the employer surveys.

Finally, improved outcomes have not been factored into these indexes. Whether or not BLS publishes disease based indexes, accounting for outcome improvements will continue to be a deficiency. At this point in time, it is difficult to estimate a reliable value that the consumer places on the outcome. Using an approach such as Cutler et. al (1998) where a dollar value is placed on an additional Quality Adjusted Life Year is just too controversial to incorporate into a monthly published index.

Table 1
Co Morbidity Indicators

Year	Physician Office Visits			
	Mean Number of Diseases per Visit	Number of Visits for 1 Disease	Number of Visits with 2 Diseases	Number of Visits with 3 Diseases
1996	1.532	914,097,000	88,510,626	23,576,756
1997	1.802	857,015,927	105,222,051	27,585,681
1998	1.780	877,451,281	110,900,249	30,690,505
1999	1.800	845,212,132	116,441,032	27,143,362
2000	1.939	847,517,668	103,487,437	31,378,739
2001	1.900	936,244,257	110,942,893	36,068,550
2002	2.085	1,006,756,597	131,275,941	39,673,678
2003	2.216	1,012,850,592	143,401,176	40,693,481
2004	2.033	1,026,306,773	156,835,092	40,904,072

Table 2
Incidence of Number of Unreimbursed Emergency Room Visits

Year	Status	% of visits unreimbursed
1998	All	7.14%
1998	Privately Insured	4.34%
1998	Publicly Insured	6.87%
1998	Uninsured	24.32%
1999	All	7.54%
1999	Privately Insured	4.13%
1999	Publicly Insured	8.17%
1999	Uninsured	28.33%
2000	All	8.72%
2000	Privately Insured	5.75%
2000	Publicly Insured	7.38%
2000	Uninsured	31.12%
2001	All	9.21%
2001	Privately Insured	6.67%
2001	Publicly Insured	8.15%
2001	Uninsured	27.74%
2002	All	6.48%
2002	Privately Insured	4.01%
2002	Publicly Insured	5.67%
2002	Uninsured	26.16%
2003	All	7.60%
2003	Privately Insured	5.04%
2003	Publicly Insured	6.15%
2003	Uninsured	27.34%
2004	All	8.39%
2004	Privately Insured	5.73%
2004	Publicly Insured	5.98%
2004	Uninsured	33.34%

Table 3
Emergency Room Prices,
Average Prices based on All Visits and Just Reimbursed Visits

Year	Visit Type	Price per Visit	Standard Error	Yearly Price Growth
1998	All Visits	$381.38	6.4	
1998	Reimbursed Visits	$410.69	6.5	
1999	All Visits	$399.60	9.1	4.78%
1999	Reimbursed Visits	$432.21	9.4	5.24%
2000	All Visits	$410.21	8.2	2.65%
2000	Reimbursed Visits	$449.39	8.5	3.97%
2001	All Visits	$463.82	9.1	13.07%
2001	Reimbursed Visits	$510.85	9.5	13.68%
2002	All Visits	$493.93	9.1	6.49%
2002	Reimbursed Visits	$528.16	9.4	3.39%
2003	All Visits	$524.84	8.2	6.26%
2003	Reimbursed Visits	$567.98	8.4	7.54%
2004	All Visits	$646.73	14.7	23.22%
2004	Reimbursed Visits	$705.99	15.3	24.30%

Relationship between Growth in Bad Debt
Incidence and Price Differentials

Year	Yearly Growth in Bad Debt Incidence	Difference in Price Growth between All Visits and Reimbursed Visits
1999	5.72%	0.46%
2000	15.56%	1.32%
2001	5.61%	0.61%
2002	-29.60%	-3.10%
2003	17.21%	1.28%
2004	10.50%	1.07%

Table 4
Number of Diagnoses
(In millions)

Disease	1998	1999	2000	2001	2002	2003	2004
Infectious Diseases	25.1	23.8	24.5	26.2	26.1	26.0	23.9
Neoplasms	17.2	16.9	17.2	18.9	20.7	20.6	20.1
Endocrine, Nutritional, and Related Diseases	47.1	50.2	55.0	60.8	64.7	67.7	75.6
Diseases of the Blood	3.1	3.3	3.9	4.2	4.2	4.1	4.2
Mental disorders	40.7	38.2	39.8	45.7	54.5	56.0	59.7
Diseases of the nervous system	85.5	79.1	76.9	81.7	82.6	86.6	88.2
Diseases of the circulatory system	65.7	65.1	68.8	72.4	80.0	83.6	87.5
Diseases of the respiratory system	175.6	172.7	168.9	183.2	179.1	184.4	177.4
Diseases of the digestive system	79.1	82.1	82.7	83.4	90.4	93.8	92.2
Diseases of the genitourinary system	34.7	35.3	38.0	40.8	41.3	41.8	41.3
Complications of pregnancy	13.7	14.6	16.9	18.4	18.0	19.0	18.8
Diseases of the skin	27.4	25.8	28.2	31.4	31.6	30.9	29.2
Diseases of the musculoskeletal system	75.9	75.8	76.4	86.3	96.6	99.6	102.6
Congenital anomalies	2.3	1.6	1.6	1.7	1.7	1.8	1.9
Certain conditions in the prenatal period	0.4	0.5	0.8	0.8	0.9	1.1	0.9
Injury and poisoning	64.3	60.1	60.8	64.7	66.1	68.0	68.5
Other conditions	64.2	66.6	71.3	79.2	81.7	83.4	83.7

Table 5
National Expenditures by For Various Medical Items by Major Disease
(in $ billions)

Year	Disease	Physicians	Outpatient Services	Emergency Room	Pharmac-uetical	Inpatient Hospital	Total	Cummula-tive Growth in Totals
1998	Infectious and parasitic diseases	1.61	0.56	0.44	1.92	2.81	7.33	1.00
1999	Infectious and parasitic diseases	2.32	0.52	0.38	2.21	5.72	11.16	1.52
2000	Infectious and parasitic diseases	2.07	0.54	0.25	1.74	4.56	9.16	1.25
2001	Infectious and parasitic diseases	2.46	0.50	0.55	2.58	2.19	8.27	1.13
2002	Infectious and parasitic diseases	2.62	0.81	0.54	4.21	8.21	16.39	2.23
2003	Infectious and parasitic diseases	3.15	0.88	0.47	4.69	2.55	11.74	1.60
2004	Infectious and parasitic diseases	3.19	0.85	0.65	5.41	4.40	14.50	1.98
1998	Neoplasms	9.08	8.01	0.18	1.51	22.54	41.32	1.00
1999	Neoplasms	8.59	5.70	0.24	1.36	17.86	33.75	0.82
2000	Neoplasms	9.95	7.22	0.22	1.16	23.78	42.33	1.02
2001	Neoplasms	14.61	8.76	0.31	1.82	23.81	49.31	1.19
2002	Neoplasms	15.03	9.78	0.41	1.68	25.79	52.69	1.28
2003	Neoplasms	13.32	15.41	0.36	1.77	23.07	53.93	1.31
2004	Neoplasms	22.85	11.62	0.49	2.09	30.19	67.25	1.63
1998	Endocrine, nutritional,and metabolic diseases and immunity disorders	7.63	1.49	0.39	10.85	9.39	29.75	1.00
1999	Endocrine, nutritional,and metabolic diseases and immunity disorders	7.25	1.04	0.35	13.89	7.86	30.38	1.02
2000	Endocrine, nutritional,and metabolic diseases and immunity disorders	9.04	1.97	0.65	16.42	6.77	34.85	1.17
2001	Endocrine, nutritional,and metabolic diseases and immunity disorders	9.42	4.19	0.93	23.18	9.55	47.27	1.59
2002	Endocrine, nutritional,and metabolic diseases and immunity disorders	12.45	3.37	0.65	24.19	9.89	50.55	1.70
2003	Endocrine, nutritional,and metabolic diseases and immunity disorders	13.13	2.52	0.95	29.72	11.10	57.43	1.93
2004	Endocrine, nutritional,and metabolic diseases and immunity disorders	16.24	2.86	0.87	33.72	14.45	68.14	2.29
1998	Diseases of the blood and blood-forming organs	0.61	0.24	0.05	0.21	1.16	2.27	1.00
1999	Diseases of the blood and blood-forming organs	0.47	0.21	0.03	0.31	2.27	3.29	1.45
2000	Diseases of the blood and blood-forming organs	0.81	0.32	0.06	0.31	1.09	2.60	1.15
2001	Diseases of the blood and blood-forming organs	1.26	0.76	0.05	0.55	2.38	5.00	2.21
2002	Diseases of the blood and blood-forming organs	1.50	1.03	0.15	0.45	1.96	5.09	2.24
2003	Diseases of the blood and blood-forming organs	1.40	0.26	0.08	0.64	1.80	4.18	1.85
2004	Diseases of the blood and blood-forming organs	1.38	0.84	0.20	0.54	2.32	5.27	2.33

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Year	Disease	Physicians	Outpatient Services	Emergency Room	Pharmac-uetical	Inpatient Hospital	Total	Cummula-tive Growth in Totals
1998	Mental disorders	9.26	3.51	0.25	9.24	12.08	34.35	1.00
1999	Mental disorders	8.01	2.27	0.22	8.78	17.18	36.45	1.06
2000	Mental disorders	9.48	1.94	0.27	13.77	7.68	33.14	0.96
2001	Mental disorders	11.23	1.19	0.57	15.50	10.66	39.13	1.14
2002	Mental disorders	14.89	1.73	0.96	17.31	12.58	47.47	1.38
2003	Mental disorders	13.60	2.05	0.82	20.19	9.95	46.61	1.36
2004	Mental disorders	15.63	1.61	0.73	22.94	10.64	51.55	1.50
1998	Diseases of the nervous system and sense organs	13.04	7.33	1.33	5.20	9.09	35.99	1.00
1999	Diseases of the nervous system and sense organs	12.05	5.59	1.11	5.83	6.19	30.76	0.85
2000	Diseases of the nervous system and sense organs	12.65	5.38	1.16	6.35	9.94	35.49	0.99
2001	Diseases of the nervous system and sense organs	15.32	6.95	1.95	7.42	9.60	41.24	1.15
2002	Diseases of the nervous system and sense organs	20.22	8.43	1.84	9.07	10.72	50.29	1.40
2003	Diseases of the nervous system and sense organs	20.67	8.55	1.90	10.20	51.99	93.31	2.59
2004	Diseases of the nervous system and sense organs	22.86	7.63	2.37	10.72	11.31	54.90	1.53
1998	Diseases of the circulatory system	11.42	5.69	2.62	16.02	63.23	98.98	1.00
1999	Diseases of the circulatory system	12.34	4.83	1.93	19.24	66.20	104.55	1.06
2000	Diseases of the circulatory system	13.85	6.50	2.96	19.76	71.51	114.57	1.16
2001	Diseases of the circulatory system	15.87	7.80	3.73	22.97	64.19	114.57	1.16
2002	Diseases of the circulatory system	20.34	7.85	4.29	25.48	67.99	125.95	1.27
2003	Diseases of the circulatory system	18.72	10.61	4.71	29.85	79.54	143.43	1.45
2004	Diseases of the circulatory system	22.50	10.71	6.38	32.57	91.06	163.21	1.65
1998	Diseases of the respiratory system	10.75	2.35	1.74	9.21	27.63	51.67	1.00
1999	Diseases of the respiratory system	10.07	2.52	2.16	11.33	22.72	48.80	0.94
2000	Diseases of the respiratory system	10.31	2.26	2.22	11.28	26.35	52.43	1.01
2001	Diseases of the respiratory system	13.37	3.10	2.78	16.76	29.37	65.37	1.27
2002	Diseases of the respiratory system	15.52	4.71	3.13	19.40	24.79	67.54	1.31
2003	Diseases of the respiratory system	14.57	3.43	3.40	20.25	26.97	68.62	1.33
2004	Diseases of the respiratory system	13.93	3.31	3.64	19.88	38.33	79.09	1.53
1998	Diseases of the digestive system	4.42	4.70	1.39	5.10	20.48	36.09	1.00
1999	Diseases of the digestive system	4.84	4.59	2.05	5.82	18.24	35.54	0.98
2000	Diseases of the digestive system	5.33	4.68	1.99	6.56	21.07	39.62	1.10
2001	Diseases of the digestive system	5.91	6.37	2.31	9.79	23.18	47.56	1.32

Year	Disease	Physicians	Outpatient Services	Emergency Room	Pharmac-uetical	Inpatient Hospital	Total	Cummula-tive Growth in Totals
2002	Diseases of the digestive system	7.53	6.79	2.53	11.67	29.79	58.32	1.62
2003	Diseases of the digestive system	8.19	8.17	3.46	15.51	24.52	59.85	1.66
2004	Diseases of the digestive system	10.90	9.46	3.75	16.26	43.23	83.59	2.32
1998	Diseases of the genitourinary system	5.94	4.66	1.05	3.39	9.17	24.21	1.00
1999	Diseases of the genitourinary system	5.85	3.56	0.63	3.74	9.89	23.68	0.98
2000	Diseases of the genitourinary system	6.26	5.18	1.41	3.76	11.60	28.21	1.17
2001	Diseases of the genitourinary system	9.14	7.69	1.61	4.44	10.25	33.13	1.37
2002	Diseases of the genitourinary system	12.02	9.28	2.52	5.03	10.96	39.82	1.64
2003	Diseases of the genitourinary system	11.71	8.88	2.27	6.54	17.85	47.26	1.95
2004	Diseases of the genitourinary system	14.85	10.24	2.68	5.80	16.73	50.30	2.08
1998	Complications of pregnancy, childbirth, and the puerperium	3.81	1.34	0.36	0.78	15.09	21.39	1.00
1999	Complications of pregnancy, childbirth, and the puerperium	4.60	0.93	0.19	1.15	15.81	22.69	1.06
2000	Complications of pregnancy, childbirth, and the puerperium	5.35	0.84	0.76	1.20	16.79	24.95	1.17
2001	Complications of pregnancy, childbirth, and the puerperium	5.59	1.72	0.53	1.46	18.28	27.58	1.29
2002	Complications of pregnancy, childbirth, and the puerperium	5.94	0.97	0.63	1.53	24.09	33.16	1.55
2003	Complications of pregnancy, childbirth, and the puerperium	6.14	1.39	0.57	2.19	24.38	34.67	1.62
2004	Complications of pregnancy, childbirth, and the puerperium	6.45	2.04	0.61	2.16	23.93	35.20	1.65
1998	Diseases of the skin and subcutaneous tissue	3.41	1.13	0.23	1.82	1.96	8.56	1.00
1999	Diseases of the skin and subcutaneous tissue	3.27	0.96	0.18	2.13	2.15	8.69	1.02
2000	Diseases of the skin and subcutaneous tissue	3.65	1.10	0.21	2.16	4.71	11.83	1.38
2001	Diseases of the skin and subcutaneous tissue	4.55	1.47	0.62	2.83	2.66	12.12	1.42
2002	Diseases of the skin and subcutaneous tissue	5.37	1.48	0.40	2.85	4.50	14.59	1.71
2003	Diseases of the skin and subcutaneous tissue	5.21	1.24	0.57	3.23	4.78	15.02	1.76
2004	Diseases of the skin and subcutaneous tissue	5.56	1.74	0.50	3.15	6.94	17.89	2.09
1998	Diseases of the musculoskeletal system and connective tissue	16.78	6.55	1.04	5.45	15.10	44.93	1.00
1999	Diseases of the musculoskeletal system and connective tissue	15.30	5.75	0.64	7.40	16.92	46.02	1.02
2000	Diseases of the musculoskeletal system and connective tissue	20.15	5.41	0.84	8.55	15.50	50.45	1.12
2001	Diseases of the musculoskeletal system and connective tissue	24.60	7.23	1.33	12.21	20.53	65.89	1.47
2002	Diseases of the musculoskeletal system and connective tissue	26.84	9.33	1.87	13.63	19.59	71.26	1.59
2003	Diseases of the musculoskeletal system and connective tissue	30.61	11.07	1.23	17.22	21.90	82.03	1.83
2004	Diseases of the musculoskeletal system and connective tissue	34.10	12.51	2.60	17.82	23.54	90.57	2.02
1998	Congenital anomalies	0.41	0.41	0.04	0.09	2.32	3.26	1.00

Year	Disease	Physicians	Outpatient Services	Emergency Room	Pharmac-uetical	Inpatient Hospital	Total	Cummula-tive Growth in Totals
1999	Congenital anomalies	0.61	0.27	0.02	0.07	3.19	4.17	1.28
2000	Congenital anomalies	0.54	0.51	0.01	0.07	1.00	2.13	0.65
2001	Congenital anomalies	0.68	0.51	0.15	0.15	1.53	3.02	0.92
2002	Congenital anomalies	0.78	0.92	0.02	0.19	2.08	3.98	1.22
2003	Congenital anomalies	0.85	0.49	0.04	0.15	4.51	6.03	1.85
2004	Congenital anomalies	1.20	0.88	0.02	0.22	1.49	3.81	1.17
1998	Injury and poisoning	11.50	6.47	6.42	1.08	19.56	45.03	1.00
1999	Injury and poisoning	12.89	6.53	6.95	1.56	23.79	51.73	1.15
2000	Injury and poisoning	13.59	5.98	6.14	1.74	19.60	47.05	1.04
2001	Injury and poisoning	14.93	5.99	8.09	1.85	24.21	55.06	1.22
2002	Injury and poisoning	16.27	5.31	9.04	2.26	27.81	60.69	1.35
2003	Injury and poisoning	16.92	7.91	9.15	2.38	59.44	95.80	2.13
2004	Injury and poisoning	19.94	8.85	11.37	2.20	25.94	68.29	1.52
1998	Other conditions	5.04	2.35	0.80	5.87	7.39	21.44	1.00
1999	Other conditions	5.91	1.66	0.87	7.47	4.22	20.13	0.94
2000	Other conditions	6.27	2.14	0.76	8.74	5.81	23.73	1.11
2001	Other conditions	8.15	2.06	1.05	11.45	5.26	27.97	1.30
2002	Other conditions	9.85	3.01	1.40	13.15	8.72	36.12	1.68
2003	Other conditions	9.69	3.45	1.48	14.48	19.56	48.66	2.27
2004	Other conditions	11.48	3.36	2.03	16.64	10.65	44.16	2.06
1998	NO DIAGNOSIS	1.53	0.15	0.02	0.12	0.01	1.82	1.00
1999	NO DIAGNOSIS	1.30	0.17	0.01	0.12	0.02	1.62	0.89
2000	NO DIAGNOSIS	1.28	0.10	0.01	0.14	0.09	1.62	0.89
2001	NO DIAGNOSIS	1.56	0.23	0.05	0.10	0.01	1.94	1.06
2002	NO DIAGNOSIS	1.89	0.24	0.08	0.18	0.02	2.41	1.32
2003	NO DIAGNOSIS	1.62	0.29	0.02	0.14	0.00	2.07	1.13
2004	NO DIAGNOSIS	2.12	0.21	0.08	0.33	0.01	2.75	1.51

Table 6

A Comparison of the Various "All-Disease" Price Indexes , 1999-2004

Scope	(1) Updated Utilization	(2) Lowes Approach	(3) Adjusted for Co-morbidities	(1)-(2)	Significant at 5%	(1)-(3)	Significant at 5%
Total Expendiutures	1.3342	1.3585	1.3091	-0.0243	*	0.0251	*
Out-ofPocket-Only	1.3163	1.2831	1.3057	0.0332	*	0.0106	
BLS Scope	1.3055	1.3032	1.2881	0.0024		0.0175	*

Table 7

Price Indexes by Disease for the Total Expenditure Scope, 1999-2004

Disease	(1) Updated Utilization	(2) Lowes Approach	(3) Adjusted for Co-morbidities	(1)-(2)	Significant at 5%	(1)-(3)	Significant at 5%
Infectious and parasitic diseases	1.6888	1.3715	1.7842	0.3172	*	-0.0954	
Neoplasms	1.2919	1.3935	1.3117	-0.1015	*	-0.0198	
Endocrine, nutritional,and metabolic diseases and immunity disorders	1.4301	1.3332	1.3953	0.0970	*	0.0348	*
Diseases of the blood and blood-forming organs	1.2082	1.3984	1.0957	-0.1902		0.1124	
Mental disorders	1.0716	1.3554	1.0202	-0.2838	*	0.0514	
Diseases of the nervous system and sense organs	1.4635	1.3467	1.4738	0.1168	*	-0.0103	
Diseases of the circulatory system	1.3758	1.3980	1.3207	-0.0222		0.0550	*
Diseases of the respiratory system	1.3383	1.3740	1.2477	-0.0357	*	0.0906	*
Diseases of the digestive system	1.2307	1.3882	1.2619	-0.1575	*	-0.0312	
Diseases of the genitourinary system	1.3243	1.3736	1.3215	-0.0493		0.0029	
Complications of pregnancy, childbirth, and the puerperium	1.1397	1.3804	1.1403	-0.2407	*	-0.0006	
Diseases of the skin and subcutaneous tissue	1.6834	1.3282	1.5800	0.3553	*	0.1035	*
Diseases of the musculoskeletal system and connective tissue	1.2111	1.3478	1.2171	-0.1367	*	-0.0060	
Congenital anomalies	1.6399	1.3983	1.8169	0.2416	*	-0.1770	
Injury and poisoning	1.6016	1.3812	1.5547	0.2204	*	0.0470	
Other conditions	1.3488	1.3350	1.2694	0.0137		0.0793	*
NO DIAGNOSIS	1.2304	1.3267	1.2407	-0.0963		-0.0103	
Dental maintenance	1.1954	1.2225	1.1954	-0.0271	*	0.0000	
Dental disease	1.2381	1.2225	1.2381	0.0156		0.0000	

Table 8

Price Indexes by Disease for the Out-of-Pocket Only Scope, 1999-2004

Disease	(1) Updated Utilization	(2) Lowes Approach	(3) Adjusted for Comorbidities	(1)-(2)	Significant at 5%	(1)-(3)	Significant at 5%
Infectious and parasitic diseases	1.5235	1.2849	1.5260	0.2386	*	-0.0025	
Neoplasms	1.2910	1.3379	1.2900	-0.0468	*	0.0010	
Endocrine, nutritional,and metabolic diseases and immunity disorders	1.4133	1.2887	1.4117	0.1246	*	0.0017	
Diseases of the blood and blood-forming organs	1.2942	1.2929	1.2266	0.0013		0.0676	*
Mental disorders	1.1403	1.3362	1.1095	-0.1959	*	0.0308	
Diseases of the nervous system and sense organs	1.3839	1.2826	1.3540	0.1013	*	0.0298	
Diseases of the circulatory system	1.3678	1.3036	1.3677	0.0642	*	0.0001	
Diseases of the respiratory system	1.3361	1.3090	1.3122	0.0271	*	0.0238	*
Diseases of the digestive system	1.3909	1.3143	1.4042	0.0766	*	-0.0133	
Diseases of the genitourinary system	1.3742	1.3060	1.3579	0.0682	*	0.0163	
Complications of pregnancy, childbirth, and the puerperium	1.2596	1.3000	1.2608	-0.0405	*	-0.0012	
Diseases of the skin and subcutaneous tissue	1.5048	1.2833	1.4791	0.2215	*	0.0257	
Diseases of the musculoskeletal system and connective tissue	1.3247	1.2830	1.2999	0.0416	*	0.0247	*
Congenital anomalies	1.7671	1.3247	1.8168	0.4424	*	-0.0497	
Injury and poisoning	1.5010	1.3304	1.4913	0.1706	*	0.0097	
Other conditions	1.4494	1.2894	1.4100	0.1600	*	0.0393	*
NO DIAGNOSIS	1.1539	1.2748	1.1825	-0.1209	*	-0.0286	
Dental maintenance	1.1954	1.2225	1.1954	-0.0271	*	0.0000	
Dental disease	1.2381	1.2225	1.2381	0.0156		0.0000	

Table 9

Price Indexes by Disease for the BLS Scope, 1999-2004

Disease	(1) Updated Utilization	(2) Lowes Approach	(3) Adjusted for Co-morbidities	(1)-(2)	Significant at 5%	(1)-(3)	Significant at 5%
Infectious and parasitic diseases	1.5359	1.3038	1.5644	0.2321	*	-0.0285	
Neoplasms	1.3434	1.3752	1.3407	-0.0318		0.0028	
Endocrine, nutritional,and metabolic diseases and immunity disorders	1.4133	1.2965	1.4042	0.1168	*	0.0091	
Diseases of the blood and blood-forming organs	1.2668	1.3130	1.1844	-0.0462		0.0824	*
Mental disorders	1.0627	1.3763	1.0083	-0.3136	*	0.0544	
Diseases of the nervous system and sense organs	1.4059	1.3032	1.3842	0.1028	*	0.0217	
Diseases of the circulatory system	1.3779	1.3286	1.3612	0.0493	*	0.0167	
Diseases of the respiratory system	1.3425	1.3401	1.2896	0.0024		0.0529	*
Diseases of the digestive system	1.3483	1.3489	1.3626	-0.0006		-0.0143	
Diseases of the genitourinary system	1.3907	1.3362	1.3773	0.0545		0.0134	
Complications of pregnancy, childbirth, and the puerperium	1.1929	1.3315	1.1976	-0.1385	*	-0.0047	
Diseases of the skin and subcutaneous tissue	1.5632	1.2987	1.5231	0.2645	*	0.0401	*
Diseases of the musculoskeletal system and connective tissue	1.2854	1.3028	1.2612	-0.0174	*	0.0242	*
Congenital anomalies	1.6978	1.3612	1.7998	0.3367	*	-0.1019	
Injury and poisoning	1.5500	1.3674	1.5417	0.1827	*	0.0084	
Other conditions	1.4211	1.3027	1.3645	0.1184	*	0.0566	*
NO DIAGNOSIS	1.2068	1.2980	1.2262	-0.0912	*	-0.0194	
Dental maintenance	1.1954	1.2225	1.1954	-0.0271	*	0.0000	
Dental disease	1.2381	1.2225	1.2381	0.0156		0.0000	

Table 10

Ratio of Out-of-Pocket Payments to Total Payments

Year	Total Expenditures	Emergency Room Facilities	Emergency Room Physicians	Outpatient Facilities	Outpatient Physician	Inpatient Facilities	Inpatient Physician	Office Based Visits	Prescriptions
1998	19.3%	15.7%	13.0%	8.1%	6.4%	2.7%	4.4%	18.2%	48.0%
1999	19.2%	14.7%	10.4%	5.1%	6.2%	2.6%	3.7%	18.0%	46.2%
2000	19.4%	11.7%	14.6%	8.1%	5.5%	2.0%	3.5%	16.8%	46.1%
2001	19.7%	11.6%	13.6%	6.8%	7.0%	1.8%	5.6%	15.2%	44.0%
2002	19.1%	11.0%	13.1%	5.9%	8.1%	2.0%	5.1%	16.0%	42.3%
2003	19.6%	12.5%	11.0%	5.9%	7.6%	1.9%	3.7%	15.2%	44.9%
2004	19.0%	11.5%	13.1%	6.7%	7.6%	1.8%	5.1%	14.1%	42.2%

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[1] The years in this study are 1999 to 2004, and the Medicare Part D program has yet to be implemented.

[2] US Department of Heath, Education and Welfare, A Report to the President of Medical Prices, US Government Printing Office, Washington, DC.

[3] While the PPI program does not generate nationwide disease based indexes for entire episodes, for its General Hospital Index, it does provide a breakdown by major disease category.

[4] US Senate Finance Committee, 1996, Final Report from the Advisory Commission to Study The Consumer Price Index, Washington, DC.

[5] Song X., Marder W., Houchens R., , Conklin J.E., Bradley R., (2008), "Can A Disease-Based Price Index Improve the Estimation of the Medical CPI?," forthcoming in *Price Index Concepts and Measurement, NBER.*

[6] CNSTAT did not argue that this was a good approximation to a medical cost of living index. Bradley (2006) details the problems of generating disease based indexes.

[7] This would not be the first instance where data in monthly price index is only updated annually. Currently, in the CPI-U the expenditure weights used to generate the all-items index from the sub indexes is updated every other year.

[8] This is often referred to as a "fixed basket" index, it is the target for the statistical agencies of many countries since the surveys that are used to measure the quantities are not completed in an adequately timely fashion to generate a Laspeyres index.

[9] See Berndt, E.,(2008), "Comments on Xue Song, William D. Marder, Robert Houchens, Jonathan E. Conklin and Ralph Bradley, "Can a Disease-Based Price Index Improve the Estimation of the Medical CPI?" forthcoming in *Price Index Concepts and Measurement, NBER.*.

[10] See Bradley, R. (2008) "The Effects of Health Insurance Prices on the Cost of Living Index - The Shadow Price of Worry" BLS Manuscript.